



Munich Personal RePEc Archive

Regulations, Economic Freedom and Bank Performance: Evidence from the EU-10 Economies

E Mamatzakis and a kalyvas

University of Sussex

18. November 2013

Online at <http://mpa.ub.uni-muenchen.de/51878/>

MPRA Paper No. 51878, posted 7. December 2013 04:45 UTC

Regulations, Economic Freedom and Bank Performance: Evidence from the EU-10 Economies

Emmanuel Mamatzakis^a, Antonios Kalyvas and Jenifer Piesse

Abstract

Cost inefficiency scores for banks in ten new EU member countries of Central and Eastern Europe are estimated using a parametric approach (stochastic frontier analysis) for the period prior to and immediately following their accession (2000-2010). These are then employed in both static and dynamic panels to estimate the impact of regulation on bank specific inefficiency in the transition economies. Using the Fraser Index of Economic Freedom (Gwartney et. al, 2012) we find that, among all the indices of economic freedom, the composite regulation index that includes regulation in credit, labour and business is the one that has more importance for the banking sector as it exerts a negative and statistically significant impact on bank inefficiency. By decomposing the regulation index, into its three components (credit, business and labour regulation) we find that strict labour regulation is associated with higher bank inefficiency while certain aspect of credit regulation such as foreign ownership and competition as well as private ownership are significantly associated with decreased bank inefficiency. The dynamic panel-VAR results using impulse response functions and variance decomposition support the validity of these results further. These results are valuable for both academics and policy makers in their attempts to understand what could drive bank inefficiency.

Keywords: Regulation; bank cost efficiency; new EU member states.

JEL Classification: G21, P34, P52.

^a Corresponding Author, Emmanuel Mamatzakis, Department of Business and Management, School of Business, Management and Economics, Jubilee Building, University of Sussex, Falmer, BN1 9SL, UK; e-mail: e.mamatzakis@sussex.ac.uk.

1. Introduction and Literature Review

The on-going financial crisis possesses many challenges but also provides an opportunity to enhance efforts for financial consolidation in a constructive way. In particular, a major challenge that policy makers and market participants face alike in the financial markets refers to on-going discussions about the role of financial regulation in relation to its impact to the industry's performance. This paper focuses on the impact of regulation on the banking sector's performance, as the latter is the principal component of the well-functioning of financial markets. However, the importance of regulation is certainly not limited to the banking sector, but especially at the times of crisis, decreased bank performance may have heavy negative effects for a country's economy because of a potential destabilisation of the financial system and credit crunch effects. Evidence of credit crunch and vulnerable financial markets have been observed over recent years, making a case to study further the importance of regulation in difficult times.

At the outset it is worth mentioning that regulation in general has very different layers and as such cover different sectors whilst some also the economy as a whole, some are industry specific other are more general. The literature that relates regulation to bank performance so far has been largely dominated by regulation specific to the banking/financial sector as this type of prudential regulations are considered by policy makers to be an important tool to ensure a sound financial system. In the recent years there has been an increasing amount of cross-country empirical studies that links financial regulation and supervisory practices to bank performance (Barth et al., 2004; Beck et al., 2006; Pasiouras, 2008; Pasiouras et al., 2009; Barth et al. 2010; Delis et al., 2011)¹. A consensus though in the literature on what

¹ Barth (2004) examines supervisory practices and regulations in the banking sectors of 107 economies and finds a positive and significant impact of private monitoring on bank performance but not a statistically significant relationship between bank performance and official supervisory power and capital stringency. Beck et al. (2006) in a study of 2,500 firms across 37 countries find that supervisory strategy that focuses on empowering private monitoring of banks by forcing them to disclose accurate information to the private sector tends to lower the degree to which corruption of bank officials is an obstacle to firms raising external finance. Pasiouras (2008) examines the effect of a series of financial regulations on the performance of banks as measured by technical efficiency and finds that although strict capital adequacy, market discipline power and powerful supervision are positively associated with efficiency, the effect is statistically significant only for regulation related to market discipline power. In another study, Pasiouras et al. (2009) investigate the impact of the three pillars of Basel II and restrictions on bank activities on bank efficiency. The authors find that regulation that boosts market discipline and the supervisory power of authorities is positively related with bank efficiency. On the other hand, restrictions on bank activities increase profit efficiency but reduce cost efficiency, while stricter capital requirements have the opposite effect. Barth et al. (2010) examined whether bank regulation, supervision and monitoring improves bank efficiency, based on an unbalanced panel of around 4,000 observation in 72 countries over the 1999-2007 period. The authors find that tighter restrictions on bank activities have a negative impact on bank efficiency, while increased capital regulation stringency has a marginal positive effect on efficiency. They

constitutes good regulation, or how specific regulations influence the performance and stability of the banking sector (see e.g. Demirgüç-Kunt et al., 2008) has not been reached. What is striking though is the absence of any studies that have thoroughly examined the impact of non-financial regulation on bank performance. This is of additional importance in light of the recent financial turmoil as many countries enhance efforts to improve their competitiveness and foster growth with structural reforms related to their business environment in parallel with an exercise of armouring their financial sector to weather out the crisis. By no means, this is an easy task.

Early empirical studies of bank crisis determinants such as Demirgüç-Kunt and Detragiache (1998, 2002) find that better institutional quality at the country-level decreases the probability for a country to experience banking crises and limits the impact of moral hazard due to deposit insurance. Institutional variables, such as rule of law and quality of bureaucracy, in these studies are interpreted as proxies for bank-specific supervision and regulation because of data unavailability of these dimensions at the time. Data availability on bank-specific regulation led to studies that are focusing on such regulations while indices of non-bank specific institutional and regulatory quality are being used as control variables. The research philosophy behind such an approach is to examine not only whether bank-specific regulations exist as legislation but also to what extent they are being practically enforced. Even in such a framework the, importance of the non-financial institutional and regulatory framework in explaining cross-country differences in bank performance is emphasized by Demirgüç-Kunt et al. (2004)². On the other hand, studies that are explicitly focusing on the importance of

also find that enhanced official supervisory power is positively associated with efficiency only in countries with independent supervisory authorities. In a more recent study, Delis et al. (2011) examine the relationship between the banking regulatory and supervision framework and banking productivity in 22 transition economies. Their results indicate that private monitoring and restrictions on bank activities have a positive impact on productivity while regulation related to the first and second pillars of Basel II (capital requirements and official supervisory power) do not appear to have a statistically significant impact on productivity although they appear to gain importance in the post financial crisis period (after 2007).

² Demirgüç-Kunt et al. (2004) in a study of 1,400 banks across 72 countries find that once they control for variables reflecting the non-financial regulatory framework such as the general level of economic freedom and the level of protection of property rights, bank regulations become insignificant determinants of net interest margins in the banking sector while these non-financial regulatory indicators affect negatively net interest margins as well as bank overheads. The authors conclude that bank regulations cannot be viewed in isolation from the non-bank regulatory and institutional framework. In another study Demirgüç-Kunt et al. (2008) examine whether compliance with the Basel Core Principles (BCPs) for Effective Banking Supervision improves bank soundness. The authors confirm a significant and positive relationship between bank soundness and compliance with principles related to information provision while their results remain robust after controlling *inter alia* for country level institutional quality as proxied by the rule of law. However, the overall index of BCP loses much of its statistical significance once institutional quality is controlled for. Furthermore most of the other

country-level institutional/regulatory quality as determinants of bank inefficiency are very scarce (Lensink et al. 2008; Hasan et al. 2009).

There are three issues that emerge from previous studies that examine the impact of country-level regulations on bank performance. First of all, most studies focus on prudential and supervisory regulations specific to the banking/financial sector. Secondly, other country-level regulatory or institutional variables have been mostly used as control variables when the importance of banking/financial regulation is under examination. Finally, the scarce literature that explicitly examines the impact of institutions and regulations on bank performance does not adequately differentiate between different types of regulatory/institutional quality, which is important in order to prioritize reform efforts.

In this paper we contribute in the literature in several ways. By using the regulation components of the Fraser Index of Economic Freedom we examine the impact of credit (financial), labour and business environment regulation on bank performance (inefficiency) in the EU-10 economies. The credit regulation index used in this study is mostly related to regulation about the ownership structure of a country's banking system (government-owned banks, private banks and foreign-owned banks). Previous research on the link between the ownership structure of the banking sector and its performance provides evidence that privately owned banks perform better than their government owned counterparts (Mian, 2003; Mico et al. 2007; Cornet et al. 2010, Berger et al. 2005, Lin and Zhang, 2009). The comparatively poorer performance of government owned banks in comparison with private banks can be attributed in the influence of politics in the operation of the former (Mico et al., 2007; Dinc 2005; Khwaja and Mian, 2005, Cole 2009; Carvahlo, 2010; Sapienza; 2004).

Private banks can be categorized between foreign and domestic. The theoretical framework in research related to the comparison of the performance between domestic and foreign banks is based on two alternative hypothesis formed by Berger et al. (2000). According to the first hypothesis, the "home field advantage", domestic banks can operate more efficiently than foreign banks in their own country as they are more familiar with the local business environment and institutional framework. Under the alternative hypothesis, the "global advantage", foreign banks may possess enough firm-specific advantages to overcome the

components of the BCPs index are found not to be significant determinants of bank soundness in regressions that the rule of law index is present.

liability of being foreign and so even outperform local competitors in a host economy. In terms of emerging and less developed economies most of the evidence supports the “global advantage” hypothesis (Classens et al. 2001; Mico et al. 2007; Detragiache et al. 2001; Bonin et al. 2005; Grigorian and Manole, 2002). There are though studies in terms of emerging economies that find support for the “home field advantage” hypothesis (Yildirim and Phillipatos, 2007, Nikiel and Opiela, 2002) while some studies do not find significant differences in terms of performance between host country and foreign banks (Crystal et al. 2001; Mian 2003).

Another contribution of this study to the literature is that we investigate the impact of labor and business regulation on bank performance. As far as concerns labour regulation the relevance for the banking sector is twofold. First of all the ability of banks to control cost generally, as well as personnel expenses in particular, is an important objective for bank managers as it the efficient utilization of resources is important for success in the financial industry (Spong et al., 2005). Secondly, to the extent that labour regulation has a negative or positive impact on the performance of firms located within a national jurisdiction then this could affect the performance of the country’s banking sector through spillover effects such as lower or higher loan default rates.

The existence of labour market regulation is based on the rationale for protection of employees from arbitrary actions by employers. However, it may increase the costs of firms to employ workers and adjust employment to the optimal level (Nickel, 1997). Most of the empirical literature that relates labour regulation to economic outcomes such as output and unemployment (e.g., Botero et al., 2004, Nickell and Layard, 2000, Heckman and Pagés, 2004, Lazear, 1990, Blanchard and Wolfers, 2000 and Blanchard and Portugal, 2001) finds that strict labour regulation has a negative impact on economic performance. While there is a growing consensus in the literature related to the effects of labour regulation on employment, relatively less is known about the impact of labour regulation on productivity. When it comes to studies that focus on productivity growth the evidence is mixed. A stream of recent studies that find a negative impact of labour regulation on investment and productivity growth (Besley and Burgess 2004; Bassanini et al. 2009; Autor et al. 2007). Such productivity losses can be explained by rising employment costs as a result of stricter employment protection legislation (Bassanini and Ernst 2002; Scarpetta and Tresselt 2004). On the other hand, other recent studies such as Storm and Naastepad (2009) and Deakin & Sarkar (2008) find that

more strict labour regulation can lead to productivity gains as firms and employees are more inclined to invest in the increase the firm-specific skills of the workforce (Wasmer 2006; Auer 2007).

Business regulations and bureaucratic procedures that restrain business entry and reduce competition may also affect bank performance through spillover effects. In particular regulatory entry barriers can lead to decreased competition through decreased entrance of new firms in an industry (Klapper et al. 2006; Djankov et al. 2007). This decreased competitive pressure can lead to decreased investment (Alesina et al. 2005), reduced growth (Loyaza et al. 2005) and reduced productivity (Nicoletti and Scarpetta, 2003; Bastos and Nasir, 2004; Bourlès et al., 2010). Strict business regulation then can have a negative effect on the performance of firms located in a country and so affect the fulfilment of the obligations these firms have to the banking sector of this country. In addition to this, increased business regulation is found to induce informality (Loyaza et al. 2005) so making it harder for banks to assess the creditworthiness of a firm.

Furthermore, in order to evaluate the relative importance of economic freedom in the regulation of credit, labour and business in comparison with other elements of economic freedom we include in the initial estimations the rest of the economic freedom variables (limited size of government, legal structure and property rights, access to sound money and freedom to trade with foreigners).

Finally, we opt to focus this study in a sample of banks in the EU-10 economies that are actively involved in a process of financial integration and for who a wider definition of regulation could prove of some significance for their performance. Previous studies related to bank performance in transition economies and the ownership structure of the transition banking systems in both a country case study and cross-country framework (Taci and Zampieri, 1998; Opiela, 2001; Matousek and Taci, 2002; Nikiel and Opiela, 2002; Hasan and Marton, 2003; Dimova, 2004 ; Green et al., 2004 ; Asaftei and Kumbhakar, 2005; Bonin et al., 2005 ; Fries and Taci, 2005; Havrylchyk, 2006; Kasman and Yildirim, 2006 ; Mamatzakis et al., 2008 ; Pruteanu-Podpiera, 2008 ; Kosac et al., 2010; Fang et al., 2011) have not reached a consensus. In this respect the credit regulation components of the Fraser Index used in this study sheds more light in this issue. Furthermore, the employment of the labour and business regulation indices of the Fraser Index for the first time in the bank performance

context in combination with the fact that the transition of the EU-10 countries to full market economies is largely completed adds to the literature by identifying non-transition related regulation that could impact bank efficiency.

The rest of the paper is structured as follows. Section 2 describes the data and the methodology, Section 3 presents the econometric results. The final section concludes.

2. Variables and Methodology

2.1 Measuring Cost Inefficiency

We use data from IBCA-Bankscope for the 2000-2010 periods. The sample includes 187 commercial banks and, after removing errors and inconsistencies, 1164 bank/year observations remain in an unbalanced panel. The sample includes the majority of the commercial banks in the EU-10 economies.

In this study we follow Aigner et al. (1977) and Meeusen and Van den Broeck (1977) and opt for the stochastic frontier analysis (SFA) methodology in order to estimate bank cost inefficiency. A major advantage of this methodology is that both random error and inefficiency are incorporated in a composite error term.

More specifically, we assume the following specification for the cost frontier:

$$TC_{it} = f(P_{it}, Y_{it}, N_{it}, Z_{it}) + v_{it} + u_{it} \quad (1)$$

Where TC_{it} the total cost for firm (bank) i at year t , P is a vector of input prices Y is a vector of outputs of the firm, N a vector of fixed netputs while Z is a vector of control variables. SFA, separates the error term into two components; The term u_i , stands for bank inefficiency that is in the control of management and follows the half-normal distribution. Such inefficiency has the potential to increase the costs of a bank above the best-practice level. The term v_i on the other hand, represents fluctuations that are beyond the firm's management (are random).

For the empirical implementation of the cost frontier, the following translog specification is used³:

$$\begin{aligned} \ln TC_i = & \alpha_0 + \sum_i a_i \ln P_i + \sum_i \beta_i \ln Y_i + \frac{1}{2} \sum_i \sum_j a_{ij} \ln P_i \ln P_j + \frac{1}{2} \sum_i \sum_j \beta_{ij} \ln Y_i \ln Y_j + \\ & \sum_i \sum_j \delta_{ij} \ln P_i \ln Y_j + \sum_i \varphi_i \ln N_i + \frac{1}{2} \sum_i \sum_j \xi_{ij} \ln P_i \ln N_j + \sum_i \sum_j \xi_{ij} \ln Y_i \ln N_j + \sum_i \xi_i Z_i + u_i + v_i \end{aligned} \quad (2)$$

In the quadratic terms of the stochastic frontier model (2) we impose standard linear homogeneity and symmetry restrictions. Additionally, we include time and country effects. The model then is estimated via a maximum likelihood procedure parameterized in terms of the variance parameters $\sigma_\varepsilon^2 = \sigma_u^2 + \sigma_v^2$ and $\gamma = \sigma_u^2 / \sigma_\varepsilon^2$.

In order to define bank inputs and outputs we follow Sealey and Lindley (1977) and opt for the intermediation approach. This approach assumes that the main function of banks is to use labour and capital in order to collect funds with the scope of transforming them into loans and other income generating assets. More specifically, two inputs and two outputs are specified. Inputs include labour (as measured by personnel expenses) and financial capital while loans (net of provisions) and other earning assets (government securities, bonds, equity investments, CDs and T-bills) are the outputs.

In terms of the input prices, we calculate the price of the financial capital as the ratio of total interest expenses to total interest bearing borrowed funds while the price of labour is represented with the ratio of personnel expenses to total assets. The sum of overheads, such as personnel and administrative expenses, interest, fee, and commission expenses, represent the total cost of each bank in the sample.

Furthermore, we include the total level of equity of each bank in the model as a quasi-fixed netput. The reason for this is twofold: Firstly, equity represents an alternative source of funding for a bank. In this way, the level of equity of each bank has the potential to affect directly its cost structure (Berger and Mester, 1997). In addition to this, ignoring financial capital may lead to a biased estimation of efficiency as firms with higher equity capital, which denotes that the shareholders have more capital at stake, may behave in a more risk averse manner than firms with lower level of equity but still optimally (efficiently) given the

³ For simplification, we omit the subscripts for time (t).

risk preferences of their shareholders. Additionally we include also each bank's level of fixed assets (as a proxy for physical capital) which is also a standard in the literature related to inefficiency estimation (Berger and Mester, 1997).

Finally, in estimating the efficiency frontier in a cross-country context is important to use variables that could capture country-level heterogeneity both in terms of the general macroeconomic environment but also in terms of the banking industry of each country as both of these kind of country-level variables have an influence on the technology of banks located within specific national boundaries. Thus, we also include real GDP growth per capita as an indicator of the dynamism of each economy. To control for macroeconomic stability we include the inflation rate. Finally, we use the ratio of inhabitants per square kilometre (DENS), a measure of population density, as a proxy for bank accessibility to potential customers. Table 1 provides some descriptive statistics for the overall sample and by country over the period 2000-2010.

2.2 Determinants of Cost Inefficiency

The next part of the analysis uses the cost inefficiency scores in 3.1 to estimate the impact of the business regulatory environment in the EU-10 economies, using as control variables bank specific characteristics, the structure of the national financial systems and the level of economic development.

2.2.1 The Fraser Index of Economic Freedom and its Components

A major focus of the paper is to examine the impact of economic freedom with a particular focus of regulation on the performance of the banking sector and therefore the Fraser Index of Economic Freedom (Gwartney et. al, 2012) is included in the models. The use of this index is common in the economics literature⁴ and consists of five factors: size of government (GOV-FR); legal structure and security of property rights (LEG-FR); access to sound money (MON-FR); freedom to exchange with foreigners (TRD-FR); and regulation of credit, labour, and business (REG-FR). These are weighted and form a composite index, with 0 indicating the lowest and 10 the highest level of economic freedom. In this paper, we put a special emphasis on regulation and particularly credit regulation and its impact on the banking industry.

⁴ See for example Carlsson and Lundstrom (2002).

Thus, the credit regulations component is decomposed to account for the following: i) ownership of banks measured as percentage of deposits held in privately owned banks, ii) foreign competition defined as domestic banks face competition from foreign banks (rate of approval of foreign bank applications and the share of foreign banks over the total banking sector assets), iii) private sector credit, measuring the extent that government borrowing does not crowd out private borrowing, and iv) negative real interest rates due to interest rate controls and regulations.

The first two sub-components provide evidence on the extent to which the banking industry is dominated by private firms and whether foreign banks are permitted to compete in the market. The final two sub-components indicate the extent to which credit is supplied to the private sector and whether controls on interest rates interfere with the credit market.

The composite labour (LR-REG) and business regulations (BR-REG) components are also added in the analysis in order to examine their impact on bank performance. The LR-REG variable is designed to measure the extent to which labour market rigidities are present. In order to earn high marks in the LR-REG component, a country must allow market forces to determine wages and establish the conditions of hiring and firing, and refrain from the use of conscription. The BR-REG variable aims to identify the extent to which regulations and bureaucratic procedures restrain entry and reduce competition. In order to score high in this part of the index, countries must allow markets to determine prices and refrain from regulatory activities that retard entry into business and increase the cost of producing products. They also must refrain from using their power to extract financial payments and reward some businesses at the expense of others.

The average scores of the Economic Freedom components across the EU-10 economies over 2000-2010 periods are shown in Table 2.

(Insert Table 2 about here)

We observe that although the level of general economic freedom (ALL-FR) stands at the 7.01 level in the region, some components of the economic freedom are below that figure as for example the size of government (GOV-FR), the protection of legal rights (LEG-FR) and regulation (REG-FR) with values of 5.43, 6.26 and 6.90 respectively. It seems that reforms related to sound money (MON-FR) and trade liberalisation (TRD-FR) are more prevalent in the EU-10 economies as the regional averages for these indices stand at the 8.80 and 7.69 level respectively. At the country level, the best performers in terms of overall economic freedom (ALL-FR) are Estonia (7.82), Slovakia (7.24) and Latvia (7.21). Moreover, Estonia and Latvia score better than the regional average in all the major components of the index of

economic freedom. On the other hand, Romania (6.66) and the Czech Republic (6.90) represent the worst performers, in terms of the overall economic freedom (ALL-FR), in the region. In Table 3 the economic freedom variables over time in the EU-10 are depicted.

(Insert Table 3 about here)

The overall economic freedom (ALL-FR) in the region has generally improved from 6.42 in 2000 to 7.18 in 2010. The most improved economic freedom components is the access to sound money (MON-FR), which increased from 6.99 in 2000 to 9.25 in 2010. The variables reflecting government size (GOV-FR) and regulation (REG-FR) have also improved over the 2000-2010 period but less remarkably than the access to sound money (MON-FR) component. It is noteworthy the fact that two economic freedom components: legal rights protection (LEG-FR) and freedom to exchange with foreigners (TRD-FR) have slightly declined over the period under study.

In Table 4 the cross-country scores of the sub-components of the regulation component (REG-FR) of the Economic Freedom index over the 2000-2010 period are shown.

(Insert Table 4 about here)

One cannot fail to notice that reforms related to credit regulation (CR-REG) are more established in the EU-10 economies in comparison with freedom in the labour market (LR-REG) and business regulation (BR-REG). In fact the regional average for credit regulation (CR-REG) stands at the 8.78 level while the corresponding figures for labour regulation (LR-REG) and business regulation (BR-REG) are 5.92 and 5.96 respectively. At the country level the best performers in terms of credit regulation (CR-REG) are Bulgaria (9.77) and Estonia (9.75) while the worst is Romania (7.57). In terms of labour regulation (LR-REG) the most liberalised labour markets are Czech Republic (6.94) and Slovakia (6.60) while Slovenia (4.51) and Romania (4.99) represent the countries with the most rigid labour regulation in the EU-10 region. Moreover, business regulation (BR-REG) is significantly more liberal in Estonia (6.84) than the rest of the EU-10 economies while Bulgaria (5.60) and Poland (5.65) are the countries with the most strict business regulation (BR-REG). When it comes to the subcomponents of the credit regulation (CR-REG) index, we notice that reforms related to interest rate controls (CR-NIR) are almost completed in the EU-10 as the regional average stands at the 9.82 and no country scores below 9.40. On the other hand, the rest of the credit regulation (CR-REG) subcomponents have additional room for improvement as the regional averages for private ownership of banks (CR-OWN), competition from foreign banks (CR-COMP) and freedom from government borrowing (CR-PRS) stand at the 8.27, 8.01 and 8.26 levels respectively. There is also a significant heterogeneity in the speed that reforms for each

regulation sub-component has been adapted in the EU-10 economies as it can be show in Table 5.

(Insert Table 5 about here)

Both credit regulation (CR-REG) and labour regulation (LR-REG) have significantly improved over time in the EU-10 economies. Credit Regulation (CR-REG) has improved from 7.63 in 2000 to 8.88 in 2010 while freedom from labour regulation (LR-REG) has increased from 4.90 to 6.48 over the same period. On the other hand, business regulation has experience a slight deterioration from 6.48 in 2000 to 6.05 in 2010. The subcomponents of the credit regulation (CR-REG) that show the highest level of improvement over the period under study are the private ownership of banks (CR-OWN) and the competition from foreign banks (CR-COMP). The index for the private ownership for banks (CR-OWN) has increased from 4.75 in 2000 to 8.94 in 2010 while the competition from foreign banks variable reached the 8.64 level in 2009 while it was 6.00 in 2010. The freedom from government borrowing (CR-PRS) variable is the only credit regulation subcomponent that has experienced a decrease as it stands at the 7.70 level in 2010 while the corresponding figure for 2000 is 8.24.

2.2.2 Bank-specific and Country-specific Control Variables

A number of control variables are used to account for individual bank characteristics: total assets (TA) represent the size of the loan portfolio of each bank and is expected to have a positive impact on cost inefficiency as it may indicate higher diversification (Mester, 1993); the ratio of loans to assets (LA), which is also expected to be positive as it represents well-functioning intermediation by the bank; and finally the loan loss provisions as a share to total loans (LLP/L) is a proxy for default risk as it measures the quality of the credit portfolio. The use of such proxy for default risk though is related both to endogenous factors (“bad management” hypothesis) and exogenous to the bank factors such as systemic economic or financial crisis (“bad luck” hypothesis). Finally according to the “skimping” hypothesis, banks that dedicate a lot of resources in screening the quality of their loan portfolio may experience increased cost inefficiency in the short-term which is compensated by low cost inefficiency in the medium and long-term because of low loan loss provisions. The ratio of cash and due from banks to total assets (C/A) is used as a proxy for liquidity risk. From the one side, a high C/A ratio can serve as a defence mechanism in case of urgent liquidity issue, but on the other hand relatively high availability of liquid assets could increase bank costs because of additional expenses required in terms of storage costs and other kinds of expenses such as labour costs.

To control for financial development, domestic credit to the private sector as a share of GDP (PSC/GDP) represents the level of development of the financial sector. Moreover, to account for the level of competition on the banking industry in each country, we use the assets of the three largest banks as a share of assets of all commercial banks (the C3 ratio). Finally, to control for the general level of economic development and capture the sophistication of the domestic market, real GDP per capita in purchasing power parity (PPP) term is used.

3. Results and Discussion

3.1 Cost Inefficiency Estimates

Cost inefficiency estimation are reported in Table 6. Those inefficiency scores represent averages over the period 2000-2010.

(Insert Table 6 about here)

One cannot fail to notice that the average bank cost inefficiency for the sample is relatively low at the 17%, that is, these banks need to improve by 17%, to reach the cost efficiency frontier. Such inefficiency scores are comparable with other studies in the transition economies (see for example Kosac et al., 2005; Kasman and Yildirim, 2006). At the country level, banks in Romania and Hungary have the highest cost inefficiency levels, with scores of 0.194 and 0.184 respectively, whereas banks in Slovenia are the best performers with inefficiency scores at around 0.144. In terms of the time series, there is a real inconsistency as the early years show increasing cost efficiency levels at the mean.

(Insert Table 7 about here)

In terms of the time series, there is a steady trend of improvement during the pre-accession and accession period, which is characterised by declining cost inefficiency, levels at the mean. However, from 2005 there is a trend reversal characterised by increasing levels of inefficiency. This can be explained by the challenges faced by these countries of the new, much more competitive environment faced by the banking sectors and the liberalised markets in which they now operated.

3.2 The Determinants of Cost Inefficiency – Static Fixed Effect Results

As a first step of the analysis of the cost inefficiency determinants we reun the following general model in a static fixed effects framework:

$$\text{Inef}_{i,t} = \alpha + \beta_1 x_{i,t} + \beta_2 s_{i,t} + \beta_3 m_{i,t} + \beta_4 \text{EF}_{i,t} + e_{i,t} \quad (3)$$

, where $\text{Inef}_{i,t}$ is the vector of bank specific cost inefficiency scores from stage one, $x_{i,t}$ is a vector of bank specific explanatory variables, $m_{i,t}$ is the level of economic development, $s_{i,t}$ is a vector of financial structure variables and $\text{EF}_{i,t}$ a vector of economic freedom variables from the Fraser Index and $e_{i,t}$ is a vector of random errors.

3.2.1 Major Components of the Fraser index of Economic Freedom

The first stage of the analysis considers the impact of overall index of economic freedom (ALL-FR) and its major components (government size (GOV-FR), legal rights protection (LEG-FR), access to sound money (MON-FR), freedom to exchange with foreigners (TRD-FR) and the composite regulation index (REG-FR) on bank cost inefficiency. Eight models are estimated for the period 2000-2010. In the first base model the regressors include just the bank specific variables, financial structure and macroeconomic variables. The models 2 to 6 include each time a different component of the Fraser index of economic freedom, model 7 includes the control variables and the regressors of the all the major components of the economic freedom index contemporaneously while model 8 includes the control variables and the overall index of economic freedom (ALL-FR). These results are in Table 8.

(Insert Table 8 about here)

In terms of the bank-specific control variables, the loan to assets ratio (L/A) is significant at the 5% level in all models and exerts a negative impact on cost inefficiency. This result provides evidence that the banks in our sample with higher intermediation capacity incur lower levels of cost inefficiency. Equally, the coefficient of cash and due from banks to total assets ratio (C/A) is negative and statistically significant at the 5% level in all the specification confirm the importance of liquidity availability for increased efficiency of bank operations. Furthermore, the loan loss provision to total loans ratio (LLP/L) is statistically significant at the 1% level and has a positive coefficient in all the models banks implying that less effort on loan screening comes at a cost in terms of bank inefficiency. There is also some

tentative evidence that the more capital at risk, the stronger are shareholders' incentives to monitor management and assure that the bank operates efficiently as the coefficient of the equity to assets ratio (E/A) is negative and statistically significant at the 10% level in models 2,4, and 8. Finally, bank size, as measured by a bank's total assets (lnTA), is positively related with inefficiency however its coefficient is not statistically different from zero at any of the models. The country level control variables are generally statistically insignificant with the exception of the concentration ratio (C3) that is statistically significant at the 10% level in models 3 and 7 providing some weak evidence that decreased level of competition in the banking industry of a country is associated with increased inefficiency.

Most of the major components of the Fraser index of economic freedom as well as the overall index of economic freedom (ALL-FR) do not exert a statistically significant impact on bank inefficiency. The exception is the protection of legal rights (LEG-FR) in model 3. The coefficient of the legal rights (LEG-FR) variable is statistically significant at the 10% and positive. This result remains robust in model 7 when we control for the rest of economic freedom components. This maybe justified by a more careful screening by bank managers of operations such as loan origination when high costs are associated with the enforcement of contractual agreements (Zazzaro, 2005). The adverse impact of legislation that in theory could improve bank performance such as lower costs of contract enforcement is not new in the literature. For example, Manove et al. (2001) show that the use of collateral in the process of loan origination could lead to a significant decrease in the screening efforts of banks and as a consequence make them to provide credit to a high number of worthless projects.

3.2.2 Credit (CR-REG), Labour (LR-REG) and Business Regulation (BR-REG)

The next stage in the analysis considers the impact of the subcomponents of the regulation variable (REG-FR) of the Fraser index of economic freedom on cost inefficiency. These subcomponents include the composite credit regulation (CR-REG) and then two aspects of this: labour market conditions (LR-REG) and business regulations (BR-REG).

Four models are estimated for the period 2000-2010. As in section 4.2.1 the regressors include the bank specific variables, financial structure and macroeconomic variables as controls and the composite credit regulation (CR-REG) in the first model, the labour market regulation (LR-REG) in the second and business regulation (BR-REG) in the third. In the fourth model all the regulation sub-components are included. These results are depicted in Table 9.

(Insert Table 9 about here)

In the first model and the third models, the composite credit regulation (CR-REG) and the business regulation (BR-REG) are not statistically significant. However, the impact of labour regulation (LR-REG) in the second model is statistically significant at the 10% level and exerts a negative impact on inefficiency. These results are further confirmed in model 4 that includes all the regulation subcomponents, as the regressor of labour regulation (LR-REG) increase is statistical significance at the 5% level while retains its negative. The other two regulation variables, credit regulation (CR-REG) and business regulation (BR-RG) remain not statistically significant in the fourth model. The positive impact of liberal labour regulation on bank performance is in line with previous studies that find a negative effect of strict labour regulation on economic performance (Bassanini et al. 2009, Autor 2007) due to increased costs associated with such regulation. Furthermore, liberal reforms in the labour market may decrease employee complacency and the associated absenteeism (Ichino and Riphahn, 2005; Riphahn 2004) and increase firm performance.

With respect to the bank specific, macroeconomic and financial structure control variables the results remain largely similar to section 4.2.1. The loan to assets ratio (L/A) and the cash to assets (C/A) have a statistically significant and negative impact on inefficiency in all the models while the loan loss provisions to total loans ratio (LLP/L) continues to exerts a a statistically significant and positive impact on inefficiency. Moreover, none of the macroeconomic and financial structure variables has a statistically different zero than impact on inefficiency.

3.2.3 Decomposing Credit Regulations

Somewhat is striking that industry specific regulation, such as credit regulation (CR-REG), does not have an impact on bank specific efficiency as one would expect. A possible cause could be the high degree of aggregation in this index of regulation. To investigate, further the impact of credit regulation on bank efficiency, we next opt for its main components, as defined by CR-OWN, that is the percentage of deposits held in privately owned banks, by CR-COMP that is foreign banks presence in the domestic market, by CR-PRS that is government borrowing that does not crowd out private sector borrowing, and last by CR-NIR that is the negative interest rates. These results are available in Table 10.

(Insert Table 10 about here)

These results show that CR-OWN (model 1) is not significant whilst CR-Comp (model 2) is significant at the 5% level and has a negative impact on cost inefficiency. On the other hand, CR-PRS (model 3) carries a positive sign and it is significant at the 10% level. The result for CR-COMP variable is expected as it is a measure of openness. Furthermore, the interpretation of this variable has two dimensions. Firstly, the extent to which foreign banks are allowed to enter the domestic market may have a negative impact on inefficiency of domestic banks due to enhanced competition as any moral hazard arising from protection against external competition is removed. Secondly, the level of operations of foreign banks assert a negative impact on inefficiency because they bring technological innovation in domestic markets as well as advanced management and risk assessment expertises sourced from their global operations. This result provides evidence for the “global advantage hypothesis” posed by Berger et al. (2000) and supports the literature (Grigorian and Manole, 2002; Hasan and Marton, 2003; Fries and Taci, 2005; Bonin et al., 2005) on the advantages of the presence of foreign banks in host country markets and the ability for foreigner to hold equity in domestic banks.⁵

In terms of ownership structure, private ownership (CR-OWN) is negatively associated with cost inefficiency but not statistically significant. Thus, it appears that foreign bank penetration as part of national privatisation programmes was a more important determinant of cost inefficiency in the banking sectors of these new EU member states than simply the transfer of state owned assets to the domestic private sector.

Two other credit regulation variables remain. Credit to the private sector (CR-PRS) has a positive and significant impact on cost inefficiency. This implies that cost inefficiency is enhanced when credit is directed to the state. In this sample, good practice in risk assessment is in its infancy and government borrowing is less costly with respect to screening and probably more secure as the probability of default is lower than debt to the private sector as the loans directed towards the public sector are covered by explicit or implicit government guarantees (Mian, 2003). Furthermore, increased foreign bank presence in the EU-10 economies may favour lending to the government instead of opaque firms (Mian, 2006;

⁵ For the importance of foreign ownership on developing economies from east Europe see Matousek and Taci (2002), Dimova (2004), Fries and Taci (2005), Asaftei and Kumbhakar (2005), Havrylchyk, (2006) and Pruteanu-Podpiera (2008).

Berger et al. 2001), for which credit risk assessment based on “hard” information becomes more difficult and so more risky.

Finally, the regulation on the control of interest rates (CR-NIR) is not statistically significant. The results remain robust in the model 5 when all the regulation variables are included in the model.

With respect to the bank specific, macroeconomic and financial structure control variables the results remain largely similar to the section 4.2.1 and 4.2.2. One important difference is that in model 5 of table 10, when all the credit regulation variables are controlled for, the positive impact of the loan loss provisions to total loans ratio (LLP/L) becomes statistically insignificant.

3.3 *The Determinants of Cost Inefficiency – Dynamic Panel Data Results*

To further examine the impact of economic freedom and in particular the impact of regulation on the inefficiency of the banking systems of the EU-10 economies we employ a dynamic panel data analysis. The use of instrumental variables in the dynamic analysis deals with potential endogeneity issues. In particular we opt for the Arellano and Bover (1995) estimator and thus equation (3) takes the following form:

$$\text{Inef}_{i,t} = \alpha + \text{Inef}_{i,t-1} + \beta_1 x_{i,t} + \beta_2 s_{i,t} + \beta_3 m_{i,t} + \beta_4 \text{EF}_{i,t} + e_{i,t} \quad (4)$$

, where $\text{Inef}_{i,t}$ is the vector of bank specific cost inefficiency scores from stage one, $x_{i,t}$ is a vector of bank specific explanatory variables, $m_{i,t}$ is the level of economic development, $s_{i,t}$ is a vector of financial structure variables and $\text{EF}_{i,t}$ a vector of economic freedom variables from the Fraser Index and $e_{i,t}$ is a vector of random errors.

3.3.1 *Major Components of the Fraser index of Economic Freedom- Dynamic Estimation*

Table 11 depicts the results of the dynamic panel data estimation for the models that include the overall index of economic freedom (ALL-FR) as well as its five major components.

(Insert Table 11 about here)

In terms of the bank specific variables the equity to assets ratio exerts a negative and statistically significant at the 1% level impact on bank inefficiency reinforcing the only tentative evidence from the fixed effect specifications in section 4.2.1 that the more capital at

risk, the stronger are shareholders' incentives to monitor management and assure that the bank operates efficiently. The rest of the bank specific control variables are statistically insignificant in the dynamic panel data framework. When it comes to the country level macroeconomic variables the level of the economic development (lnGDPcap) has a positive and statistically significant in all the models in Table 11 (at the 5% level in the first six models and at the 1% level in the seventh model when we control for the overall economic freedom index (ALL-FR)). The positive and significant coefficient on the proxy for the general level of economic development (lnGDPcap) could indicate the higher operating and financial costs for supplying a given level of services (Dietsch and Lozano-Vivas, 2000). Additionally, the lagged inefficiency is positive and significant at the 1% level and its high magnitude implies the suitability of the dynamic panel data estimation.

An important result is in model 7 of Table 11 that finds the regressor of the overall economic freedom index to be negative and statistically significant at the 5% suggesting decreased bank inefficiency in countries with more liberal economic systems. Additionally, in model 5 of Table 11 the overall regulation variable (REG-FR) is statistically significant at the 5% and has a negative impact on inefficiency. This result remains robust, albeit at the lower significant level of 10%, in model 6 when we control for the rest of the major components of index of economic freedom. Moreover, the access to sound money variable (MON-FR) is found to exert a negative impact on inefficiency (see model 3 of Table 11) although this finding does not remain robust in model 6 that included the rest of the major economic freedom components. It is important to note that the static fixed effect analysis in the previous section (4.2) failed to identify a statistically significant relationship between bank inefficiency and the overall index of economic freedom (ALL-FR) and in particular with the composite index of regulation (REG-FR). Such results imply that the most important channel through which economic freedom affects bank performance is through regulation in credit, labour and business. Furthermore the dynamic analysis does not confirm the static fixed effects results in relation to the positive impact of the legal rights protection variable (LEG-FR) on inefficiency as in model 2 of Table 11 this variable is negatively related to inefficiency but not statistically significant.

3.3.2 Credit (CR-REG), Labour (LR-REG) and Business Regulation (BR-REG): Dynamic Estimation

In order to further examine the impact of regulation on bank inefficiency we decompose as in section 4.2.2 the composite regulation (REG-FR) to its major subcomponents: credit

regulation (CR-FR), labour regulation (LR-FR) and business regulation (BR-FR). The results are available in Table 12.

(Insert Table 12 about here)

The results confirm the findings of the static fixed effects specification analysed in section 3.2.2. In particular the only type of regulation that has a statistically significant impact on inefficiency is the labour regulation (LR-FR) variable (see model 2 in table 12). In the dynamic panel data analysis though the effect of labour regulation (LR-FR) on inefficiency has increased statistical significance at the 1% level as opposed to the 5% level in the static fixed effects specifications. Another channel through which liberalisation of the labour markets can affect positively firm performance is by increased innovation (Koeniger,2005; Barbosa and Faria, 2011) especially in primary innovation with high expected returns such as the introduction of new products (Saint Paul, 2002)

Furthermore, the credit regulation (CR-REG) and the business regulation variables (BR-REG), as in the static analysis, have not been found to have a significant impact on inefficiency. These results remain robust in the fourth specification of Table 12 when all the regulatory variables are included in the model.

3.3.3 Decomposing Credit Regulations: Dynamic Estimation

In Table 13 we decompose the composite credit regulation (CR-REG) index into its own subcomponents and estimate their specific effects on bank inefficiency.

(Insert Table 13 about here)

The negative association of the ownership structure (CR-OWN) with bank inefficiency found in the static fixed effects analysis is further confirmed in the dynamic panel analysis but this time the CR-OWN variable is statistically significant at the 1% level (see model 1 in Table 13). This results implies that private ownership of banks increases performance through better allocation of credit in the economy because of less political influences in such decisions (Dinc, 2005; Khwaja and Mian, 2005) and more adherence to market discipline because of absence of any explicit or implicit support from the government (Mian, 2003).

The competition from foreign banks (CR-COMP) is also statistically significant at the 1% and with a negative coefficient confirming the static results (see model 2 in Table 13). Overall the results of the dynamic analysis provide evidence that increased privatisation of

the banking system and decreased protection from foreign bank presence and competition are associated with decreased bank inefficiency. On the other hand the dynamic panel analysis does not confirm the evidence that limited crowding out of private sector borrowing because of government borrowing (CR-PRS) is a positive and statistically significant determinant of bank inefficiency. Finally, as in static analysis, the interest rate control variable (CR-NIR) does not have any statistically significant impact on inefficiency.

3.4 Sensitivity Analysis – Panel Vector Autoregressive (VAR) estimation

As part of sensitivity analysis we opt for the flexible framework of a panel-VAR analysis⁶. Essentially all variables in the panel-VAR are entering as endogenous so as to be able to resolve the causality among them. Also, another advantage of the panel-VAR is that it examines the underlying dynamic relationships compared with the static functional form of a standard fixed effects model.

For the estimation of each panel VAR we follow the same procedure. As a first step the optimal lag order j is assumed for the right-hand variables in the system of equations (Lutkepohl, 2006). The Arellano-Bond GMM estimator is used for the lags of $j=1,2$ and 3 .⁷ Optimal lag order of one is based on the Akaike Information Criterion (AIC), confirmed by Arellano-Bond AR tests. To test for autocorrelation, more lags are added. The Sargan tests show that for lag ordered one, the null hypothesis cannot be rejected and thus the VAR model is of order one. The lag order of one preserves the degrees of freedom and information, given the low time frequency of the data.

Table 9

3.4.1 Impulse Response Functions (IRFs) and Variance Decompositions (VDCs) for foreign bank competition (CR-COMP), private ownership of banks (CR-OWN), bank size ($\ln TA$) and inefficiency (INEF)

The panel-VAR framework allows the examination of the impact of the components of credit regulation on cost efficiency in more detail and are included here as a sensitivity analysis. Credit regulation is decomposed into four components: ownership (CR-Own), competition (CR-Comp), private sector credit (CR-PrS) and restrictions on interest rates (CR-NiR). As above, the Arellano-Bond GMM estimator for the lag of $j=1$ is used.

⁶ For a formal exposition of the panel VAR methodology see Appendix.

⁷ Results are available upon request.

The impulse response functions (IRF) derived from the unrestricted panel-VAR in the case of bank cost inefficiency (INEF), bank size (lnTA) and the private ownership of banks (CR-OWN) and foreign bank competition (CR-COMP) variables are presented in Figure 1. The plots show the response of each variable in the panel-VAR (INEF, lnTA, CR-OWN and CR-COMP) to its own innovation and to the innovations of the other variables. The first row shows the response of INEF on a one standard deviation shock in the lnTA, CR-OWN and CR-Comp variables.

(Insert Figure 1 about here)

It becomes apparent that the effect of CR-OWN and CR-COMP on cost inefficiency is negative over the whole period. The peak response of efficiency to both CR-OWN and CR-COMP is after the second period years, and converge towards equilibrium thereafter. In the case of CR-Own and CR-Comp the panel VAR analysis appear to confirm the previous dynamic panel results. Foreign banks, as in Fries and Taci (2005), Bonin et al. (2005), Asaftei and Kumbhakar (2005) and Havrylchyk, (2006) and Pruteanu-Podpiera (2008) through the improvement of competition conditions and technological innovations that they bring into the domestic markets enhance the performance of all banks, including domestic banks. Along these lines the ownership structure, CR-OWN is positively associated with cost inefficiency. Furthermore, the response of inefficiency to a shock in bank size (lnTA) is positive in the period under study. This result lends some support to the ‘quite life’ hypothesis, which posits that banks enjoy the advantages of market power in terms of foregone revenues or cost savings although large banks in the new EU-member states have benefited more, in terms of average cost reduction, from technological progress (Kasman & Saadet-Kasman, 2006). An additional explanation for the negative impact of total assets (lnTA) on cost efficiency could be attributed to the remaining large state owned banks that are highly inefficient.

(Insert Table 14 about here)

Table 14 presents further evidence of the importance of credit specific regulation for bank efficiency as reported by the variance decompositions (VDC) estimations for its components. These results are consistent with the IRF, and provide further evidence of the importance of regulation with respect to privately owned bank assets ownership in explaining the variation in cost efficiency. Specifically, around 1% of forecast error variance of cost inefficiency after 10 years is explained by CR-COMP regulation disturbances, whilst the corresponding

figure for CR-OWN is 0.32%. Finally, around 0.33% of forecast error variance of cost inefficiency after 10 years is explained by shocks in the bank size (lnTA).

3.4.2 Impulse Response Functions (IRFs) and Variance Decompositions (VDCs) for private sector credit (CR-PRS), interest rate controls (CR-NIR), bank size (lnTA) and inefficiency (INEF)

The impulse response functions (IRF) derived from the unrestricted panel-VAR in the case of bank cost inefficiency and the variables from of the Starting a Business category are presented in Figure 2. The plots show the response of each variable in the panel-VAR; cost inefficiency (INEF) , private sector credit (CR-PRS), interest rate controls (CR-NIR) and bank size (lnTA). The first row shows the response of INEF on a one standard deviation shock in lnTA, CR-PRS, CR-NIR.

(Insert Figure 2 about here)

The effect of both the credit regulation variables included in the panel VAR, CR-NIR and CR-PRS, is negative in the whole period of the study. However, in terms of magnitude, the peak response of inefficiency (INEF) to a shock in the interest rate control index (CR-NIR) is -0.0194 while for the private sector credit variable (CR-PRS) stands at the -0.0096. Finally, the response of inefficiency to a shock in bank size (lnTA) is positive in the whole period under study as in section 4.4.1.

(Insert Table 15 about here)

These results are further confirmed from the variance decomposition (VDC) estimations depicted in table 15. In a 10 year time frame around 1.02% of the forecast error variance of inefficiency (INEF) can be explained by disturbances in the interest rate control (CR-NIR) variable while around 0.08% from disturbances in the private sector credit (CR-PRS) variable. This result implies the beneficial for the banking sector allowance of interest rate to be determined by market forces rather than government interference.

4. Conclusion

This is the first study that tries to assess the interaction between inefficiency and regulation in the banking industry of the new EU member states. These countries are from Central and Eastern Europe and have only in the past decade or so had to manage the transition from central to a market economy. Established parametric methods (stochastic frontier analysis) are used to construct inefficiency estimation and these scores are used in both static and dynamic panel data models to investigate the impact of credit, labour and business regulation of bank inefficiency.

Using the Fraser Index of Economic Freedom we find that, among the five major components (government size, legal structure and property rights protection, access to sound money, trade freedom and regulation), the composite regulation index that includes regulation in credit, labour and business is the one that has more importance for the banking sector as it exerts a negative and statistically significant impact on bank inefficiency.

Furthermore, by decomposing the regulation index, into its three components (credit, business and labour regulation) we find that strict labour regulation is associated with higher bank inefficiency lending support to the view that more liberal labour markets are associated with increase economic performance. Furthermore, although the aggregate credit regulation index, does not exert a statistically significant impact on bank inefficiency, decomposing credit regulation further provides a richer set of results. In particular, aspects of foreign ownership and competition as well as private ownership are significantly associated with decreased bank inefficiency. The dynamic panel-VAR results using impulse response functions and variance decomposition support the validity of these results further.

The paper is timely as several EU member states appear to have fragile financial systems. Regulation of the banking sectors in the transition countries is recent and this study shows that it enhances bank operating performance. Overall, credit regulation in the transition countries is recent and this study shows it enhances bank operating performance. Labour regulation also asserts a negative impact on inefficiency. These results are valuable for both academics and policy makers in their attempts to understand what could drive bank efficiency. Clearly, following an ambitious reform agenda, in particular in terms of improving competition, are warranted.

References

- Altunbas Y., Gardener E.P.M., Molyneux P., Moore B., 2001. Efficiency in European banking. *European Economic Review* 45, 1931-1955.
- Arellano, M., Bover O, 1995. Another look at the instrumental-variable estimation of error-components models. *Journal of Econometrics*, 68, 29-52.
- Asaftei, G., Kumbhakar S., 2008. Regulation and efficiency in transition: the case of Romanian banks. *Journal of Regulatory Economics* 33(3), 253-282.
- Avkiran, N.K., 1999. The evidence on efficiency gains: The role of mergers and the benefits to the public. *Journal of Banking and Finance* 23, 991-1013.
- Bakker, B., Gulde A.M., 2010. The Credit Boom in the EU New Member States: Bad Luck or Bad Policies?, IMF Working Paper 10/130
- Baltagi B., 2005. *Econometric Analysis of Panel Data*, third ed. Wiley, New York.
- Barth, J.R., Caprio, G. Jr. and Levine, R., 2004. Bank regulation and supervision: what works best? *Journal of Financial Intermediation* 13, 205-248.
- Barth, J.R., Caprio, G. Jr., Levine, R., 2006. *Rethinking Bank Regulation Till Angels Govern*. Cambridge University Press, New York, NY.
- Beck T., Demirguc-Kunt A., Levine R., 2000. A New Database on Financial Development and Structure, *World Bank Economic Review* 14, 597-605.
- Beck, T., Demirguc-Kunt, A., Levine, R., 2006. Bank supervision and corruption in lending. *Journal of Monetary Economics* 53, 2131-2163.
- Berger, A. N., Mester, L., 1997. Inside the black box: what explains differences in the efficiencies of financial institutions? *Journal of Banking and Finance* 21 (7), 895-947.
- Berger A.N., DeYoung R., 1997. Problem loans and cost efficiency in commercial banks. *Journal of Banking and Finance* 21, 849-870.
- Berger A. N., 2007. Obstacles to a global banking system: “Old Europe” versus “New Europe”. *Journal of Banking and Finance* 31, 1955–1973.
- Berger, A.N., Klapper, L.F., Turk-Ariss R., 2008. *Banking Structures and Financial Stability*. Mimeo.
- BIS (2004). *International Convergence of Capital Measurements and Capital Standards*, Bank for International Settlements, Basel, Switzerland.
- Bonin, J., Hassan, I., Wachtel, P., 2005. Bank performance efficiency and ownership in transition countries. *Journal of Banking and Finance* 29, 31-53.

- Carlsson F., Lundstrom S., 2002. Economic freedom and growth: Decomposing the Effects. *Public Choice* 112, 335–344.
- Charnes, A., Cooper, W. W., Rhodes, E., 1978. Measuring the efficiency of decision making units. *European Journal of Operational Research*, 2, 429-444.
- Claessens, S., Demirguc-Kunt, A., Huizinga, H., 2001. How does foreign entry affect the domestic banking market? *Journal of Banking and Finance* 25, 891–911.
- Delis, M., Molyneux P., Pasiouras F., 2011. Regulations and Productivity Growth in Banking: Evidence from Transition Economies, *Journal of Money, Credit and Banking*, 43(4), 735-764.
- Demirguc-Kunt, A. Laeven, L., Levine, R., 2004. Regulations, Market Structure, Institutions, and the Cost of Financial Intermediation, *Journal of Money, Credit and Banking* 36(3), 593-622.
- Demirguc-Kunt, A., Detragiache, E., Tressel, T., 2008. Banking on the Principles: Compliance with Basel Core Principles and Bank Soundness. *Journal of Financial Intermediation* 17, 511-542.
- Dietsch, M., Lozano-Vivas A., 2000. How the environment determines banking efficiency: A comparison between French and Spanish industries. *Journal of Banking and Finance* 24, 985-1004.
- Dimova, D., 2004. The benefits of privatizing banks to strategic foreign investors: a survey of Central and Eastern Europe', Honor thesis, Stanford University, Department of Economics.
- Eisenbeis Robert A., Ferrier Gary D., Kwan Simon H., 1999. The informativeness of stochastic frontier programming frontier efficiency scores: Cost efficiency and other measures of bank holding company performance. Working Paper 99-23, Federal Reserve Bank of Atlanta.
- European Central Bank, 2005. Banking structures in the new EU Member States. European Central Bank.
- European Central Bank, 2010. EU Banking Structures. European Central Bank.
- Fang, Y., Hasan I., Marton K., 2011. Bank efficiency in South-Eastern Europe, *Economics of Transition* 19(3), 495-520.
- Farrell, M.J., 1957. The Measurement of Productive Efficiency. *Journal of the Royal Statistical Society* 120(3), 253-290.
- Ferrier, G., Lovell K., 1990. Measuring Cost Efficiency in Banking: Econometric and Linear Programming Evidence. *Journal of Econometrics*, 46, 229–245.
- Fries, S., Taci, A., 2002. Banking reform and development in transition economies. Working Paper No. 71, European Bank for Reconstruction and Development.

Fries, S., Taci, A., 2005. Cost efficiency of banks in transition: evidence from 289 banks in 15 post-communist countries. *Journal of Banking and Finance* 29, 55-81.

Green, C., Murinde, V., Nikolov, I., 2004. The efficiency of foreign and domestic banks in Central and Eastern Europe: evidence on economies of scale and scope. *Journal of Emerging Market Finance* 3 (2), 175–205.

Grigorian, D., Manole, V., 2002. Determinants of commercial bank performance in transition: an application of data envelopment analysis. Working Paper No. 2850, World Bank Policy Research.

Gwartney J.D., Hall J.C., Lawson R., 2010. *Economic Freedom of the World: 2010 Annual Report*. Vancouver, BC: The Fraser Institute. Data retrieved from www.freetheworld.com.

Hasan, I., Marton, K., 2003. Development and efficiency of a banking sector in a transitional economy: Hungarian experience. *Journal of Banking and Finance* 27, 2249-2271.

Havrylchyk, O., 2006. Efficiency in the Polish banking industry: foreign versus domestic banks. *Journal of Banking and Finance* 30, 1975-1996.

Humphrey, D.B., 1985. Costs and Scale Economies in Bank Intermediation, in: Aspinwall, R.S., Eisenbeis, R.A. (Eds.), *Handbook for Banking Strategy*. Wiley & Sons, New York, pp. 745-783.

Jemric, I., Vujcic, B., 2002. Efficiency of banks in Croatia: A DEA approach. Working Paper 7, Croatian National Bank.

Kager, M., 2002. The banking system in the accession countries on the eve of EU entry. Focus on Austria, Working Paper 2, National Bank of Austria.

Karas, A., Schoors K., Weill L., 2010. Are private banks more efficient than public banks? Evidence from Russia. *Economics of Transition* 18(1), 209-244.

Kasman, A., 2005. Efficiency and Scale Economies in Transition Economies: Evidence from Poland and the Czech Republic. *Emerging Markets Finance and Trade*, 41(2), 60–81.

Kasman A., Yildirim C., 2006. Cost and profit efficiencies in transition banking: the case of new EU members. *Applied Economics* 38, 1079-1090.

Kondeas, A., Caudill, S., Cropper, D., Raymond J, (2008). Deregulation and Productivity Changes in Banking: Evidence from European Unification. *Applied Financial Economics Letters* 4, 193-197

Kosak M, Zajc P., Zoric J., 2009. Bank Efficiency differences in the new EU member states. *Baltic Journal of Economics* 9(2), 98-100

Kraft, E., Tirtiroglu, D., 1998. Bank efficiency in Croatia: a stochastic frontier approach. *Journal of Comparative Economics* 26, 282-300.

Kraft, E., Hofler, R., Payne, L., 2002. Privatization, foreign bank entry and bank efficiency in Croatia: A Fourier-flexible function stochastic cost efficiency analysis. Working Paper No. 9, Croatian National Bank.

Love, I., Zicchino, L., 2006. Financial Development and Dynamic Investment Behavior: Evidence from Panel VAR. *The Quarterly Review of Economics and Finance* 46, 190–210.

Lütkepohl, H. (2006). *New Introduction to Multiple Time Series Analysis*. Springer, Berlin.

Mamatzakis, E., Staikouras, C., Koutsomanoli-Filippaki, A., 2008. Bank efficiency in the new European Union member states: Is there convergence? *International Review of Financial Analysis*, 17, 1156–1172.

Matousek, R., Taci, A., 2002. Banking efficiency in transition economies: empirical evidence from the Czech Republic. Discussion Paper No. 02-3, Centre for International Capital Markets, London Metropolitan University.

Mertens, A., Urga, G., 1998. Efficiency, scale and scope economies in the Ukrainian banking sector in 1998. *Emerging Markets Review* 2, 292-308.

Mester, L.J., 1993, Efficiency in the savings and loan industry, *Journal of Banking and Finance* 17, 267-286.

Nikiel, E., Opiela, T., 2002. Customer type and bank efficiency in Poland: implications for emerging market banking. *Contemporary Economic Policy* 20, 255-271.

Opiela, T.P., 2001. Assessing the efficiency of Polish commercial banks. *Materialy I Studia*, Working Paper, National Bank of Poland.

Pasiouras, F., Tanna, S., Zopounidis, C., 2009. The impact of banking regulations on banks' cost and profit efficiency: Cross-country evidence. *International Review of Financial Analysis* 18, 294-302.

Poghosyan, T., Poghosyan A., 2010. Foreign bank entry, bank efficiency and market power in Central and Eastern European Countries, *Economics of Transition* 18(3), 571-598.

Pruteanu-Podpiera, A., Weill, L., Shobert, F., 2008. Banking Competition and Efficiency: A Micro-Data Analysis on the Czech Banking Industry. *Comparative Economic Studies*, 50, 253–273.

Rossi, S., Schwaiger, M., Winkler, G., 2005. Managerial behavior and cost/profit efficiency in the banking sectors of Central and Eastern European countries. Working Paper No. 96, Oesterreichische Nationalbank.

Schardax, F., Reininger, T., 2001. The financial sector in five Central and Eastern European countries: an overview. Focus on Transition 1/2001, OeNB.

Staikouras, C., Koutsomanoli-Fillipaki A., 2006. Competition and concentration in the new European banking landscape. *European Financial Management* 12, 443–482.

Stavarek D., 2005. Efficiency of Banks in Regions at Different Stage of European Integration Process. *Ekonomie a Management* 5(1), 34-50.

Sturm, J.E., Williams B., 2004. Foreign bank entry, deregulation and bank efficiency: Lessons from the Australian experience, *Journal of Banking and Finance*, 28, 1775 – 1799.

Taci, A., Zampieri, E., 1998. Efficiency in the Czech banking sector. CERGE-EI Discussion Paper No. 4/98, Charles University: Prague.

Tang, H., Zoli, E., Klytchnikova, I., 2000. Banking crises in transition economies: fiscal costs and related issues. Working Paper, No 2484, World Bank Policy Research.

Weill, L., 2003a. Banking efficiency in transition economies: the role of foreign ownership. *The Economics of Transition* 11, 569-592.

Weill, L., 2003b. Is There a Lasting Gap in Bank Efficiency between Eastern and Western European Countries? Mimeo.

Yildirim, H.S., Philippatos, G., 2007. Efficiency of banks: recent evidence from the transition economies of europe, 1993–2000. *The European Journal of Finance* 13(2), 123–143.